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# Water Resources Management in Japan

## Policy, Institutional and Legal Issues

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# EXECUTIVE SUMMARY

Water resources development in Japan has evolved as both *economic and population growth* have placed increasing demands on Japan's fresh water resources over the past 50 years. Problems of both the quantity of available water and its quality had to be addressed. This paper reviews the evolution of planning for and financing of water resources development. Although the administrative structure is particular to Japan, there are certain broader lessons that the Japanese experience offers to other countries facing similar challenges.

A major theme in the Japanese case is the *"partnership"* element between national authorities and local-level utilities and governments. The overall framework for water resources development is set by the national government while actual implementation and management is largely left to the local level. This places implementation close to the ultimate beneficiaries, and strengthens the link between those providing the service and those using the service. Local utilities have tended to be monopolies, however, and have relied heavily on subsidies to keep prices down and avoid the "market test" of competition and full-cost pricing of their product.

A recent development in Japan has been the *increasing use of private firms* to provide specific services to local water utilities (or, in some cases, to actually manage them on behalf of the local authorities). Although this is not the same as the "privatization" of public utilities that is seen in some countries, this expanded use of contracts and private service provision has improved efficiency and reduced costs. More use of various innovative service provision modalities is expected in the future and is an interesting lesson on mixed public-private provision of a public service.

Another trend in Japan has been the *consolidation* of many small water service providers into larger aggregates. This enables the larger firms to take advantage of "economies of scale" and try to keep costs down.

The one dimension of Japanese water resources development that is not as transferable to many other countries is the very large role of *government subsidies* at all levels. Construction costs are heavily subsidized by the national government (with an appropriate sliding scale of higher subsidies for agricultural uses, sewage treatment and waste water collection, and lower subsidies for domestic water supply and industrial water supply). The level of subsidies reflects both the ability and willingness-to-pay of the water users, as well as the public goods nature of certain services (such as wastewater treatment). However, in Japan there are also substantial subsidies for management at the local utility level. These result in lower water prices to almost all users, and the subsidies both create continuing budgetary drains, but also do not encourage water conservation. The utilities lose some of the "edge" that comes from having to pay most of (part of) their operating costs, and consumers view water as a "cheaper' commodity than it really is.

Since market prices do not send full information on the costs of supplying water, Japan has tried a number of different *policy measures* to encourage conservation and

promote better efficiency of water use. These include both traditional *command-and-control measures* (especially important for pollution control problems) as well as various *economic–based measures*. Japan has used both types of measures extensively, and, especially with the economic measures, has a system in place to generate revenues to help pay for water systems operation and management (although the large role of subsidies makes water relatively "cheaper" than it would otherwise be).

The paper discusses these different policy tools being used at present, and gives examples from various sectors. A new policy tool being tried is a "resource management tax"—designed to raise revenues to manage either forested watersheds or groundwater resources—whereby water users pay a small tax to help better manage ecosystems that are the ultimate source of the water supplies. Although the taxes are small at present, the principle of payment for ecosystem services is being slowly introduced.

Finally, the paper presents considerable detail on the *legal and administrative framework* for water resources development in Japan, much of which is of course very country-specific. The most interesting point is the clear use of legal measures to set broad policy guidelines, and the use of annual plans to then design the actual water resource developments and their implementation.

# CHAPTER 1
# INTRODUCTION

This paper reviews the implementation of water resources management in Japan. The focus is primarily on the policy, legal, and institutional frameworks for water resources management, with special emphasis on the use of market-based policies as well as more traditional command-and–control policies (regulations).

Japan has periodically suffered from severe water shortages, particularly since the rapid economic and population growth that began in the 1960's. Government policies, however, combined with supporting institutional and legal frameworks, as well as enforcement, seem to have effectively addressed the problem. Hopefully the lessons from Japan will provide some useful insights for other countries, such as China, that face similar water scarcity problems in the context of rapid economic and population growth.

The paper has eight sections. After this introductory section, the second section briefly discusses the present situation of water resources availability in Japan. Sections three to five review the role of government, budgeting and financing issues, and legal frameworks for water resources management. Sections six and seven are the core of the paper. Section six discusses the use of various market-based instruments such as water tariffs, subsidies, water trading, private sector participation contacts, and special purpose taxes. Section seven discusses the use of command-and-control measures such as water resources allocation (water rights and/or permits), and water pollution controls (water quality standards and/or effluent regulations). Section eight contains concluding remarks.

# CHAPTER 2
# PRESENT SITUATION OF WATER RESOURCES AVAILABILITY IN JAPAN

Japan is not a water abundant country. It has a narrow surface area, rapid run-off of precipitation, and high population density[1]. The quantity of annual natural renewable water resources per capita in Japan (about 3,372 $m^3$ per capita) is only one half of the world average. In addition, there are great fluctuations in rainfall—both seasonally and between the years. As a result of both of these factors—an absolute shortage of water and considerable variability over time—Japan has suffered severe water shortages several times in the recent past. For example, the Tokyo metropolitan area experienced water scarcity in the early 1960's when the city of Tokyo was forced to restrict water supply for 42 months, from October 1961 to March 1965[2].

In order to solve the water scarcity problem, Japan has aggressively developed its water resources, mainly by constructing new water storage facilities (largely dams). At present, the amount of "newly developed" water sources accounts for 16.6 billion $m^3$ of water per year, which amounts to 55% of total water consumption for domestic and industrial (urban) use[3] (See Figure 2-1). In the Tokyo metropolitan region the volume of bulk water stored in reservoirs doubled from 185 million $m^3$ in 1964 to 371 million $m^3$ in 1996. In 1996, water supply was restricted for only 41 days, although annual precipitation in 1996 was lower than in 1965 (a major drought year) and Tokyo's population had increased from 8 million to 11 million between 1965 and 1996.

As in many countries, agricultural water accounts for about two thirds of total water consumption, largely because of the huge irrigation needs for paddy rice cultivation. However, this does not necessarily mean that agricultural water is used inefficiently. Irrigation water is transferred from one place to another and used repeatedly. Except for limited evapo-transpiration of water, most of the water used in irrigation is returned as either return flow to rivers or canals or as recharge to the ground water aquifer. In recent years, the demand for agricultural water has tended to decrease due to the *decrease in the area of irrigated land* used for the production of paddy.

*Industrial water use has also tended to decline,* not only because Japan has suffered from sluggish economic growth, but also because the recycling rate has steadily increased. Firms have learned to use their own

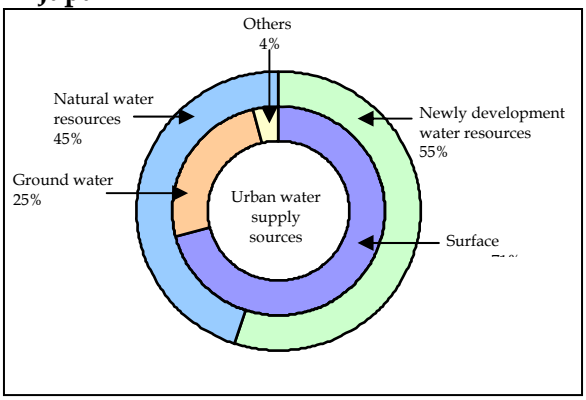
[1] In China, natural water availability is much worse than Japan. According to the AQUASTAT, natural renewable water resources per capita in China (2,186 $m^3$ per capita) is about two thirds of Japan (3,372 $m^3$ per capita). Water withdrawals per capita in China (439 $m^3$ per capita) is also about two thirds of Japan (735 $m^3$ per capita).

[2] This was the most severe water shortage in Tokyo metropolitan area after the World War II, and was called the "Tokyo Olympic Water Shortage". In 1964, water supply was restricted by up to 50% and this caused severe disruptions to the public's daily activities, such as washing and bathing at home, operation of hospitals, fire fighting, and even led to food poisoning in some cases. In addition, accumulated ground subsidence (starting in the 1930s) exceeded 4 meters during the latter half of 1960s due to ground water abstraction which amounted to a maximum of .6 million $m^3$ per day.

[3] Urban water is the sum of domestic water and industrial water.

wastewater more efficiently to save on the costs of raw water. Recycling facilities have also been developed alongside water treatment facilities as a result of the adoption of water recycling and cleaner technologies.

**Figure 2.1 Sources of urban water supply in Japan**




Source: Ministry of Land Infrastructure and Transport
1. Urban Water = domestic water + industrial water
2. "Newly developed water resources" are water resources that become available due to the construction of new dams, as estimated by the Water Resources Department, Ministry of Land, Infrastructure and Development

Over the past 20 years, *demand for domestic water, both in total and per-capita, has increased* along with the improvement in living standards. For example, almost all new apartments now have their own bathroom for bathing (whereas in the past the public bath was quite common in Japan). Recently, however, domestic water demand has been growing at a decreasing rate, in part due to decreases in population growth and a trend towards smaller families. Consequently, along with the decrease in industrial and agricultural water use, total water use in Japan, after peaking in 1995, has tended to decline for the past ten years (See Table 2-1). Under these situations, the national government, which chronically suffers huge budget deficits, has tried to stop the construction of costly newly planned dams.

*Water pollution* has decreased in general according to a recent report of the Ministry of the Environment. In particular, toxic substances designated as health-risks and controlled by Environmental Quality Standards (EQSs) (e.g. substances such as cadmium and cyanide) have decreased remarkably to levels that meet the EQSs requirements almost everywhere in Japan. Dissolved organic pollutants (largely from domestic sewage and other waste waters) remain a problem, however, with high levels of dissolved organic pollutants measured in enclosed water bodies such as bays, coastal seas, and lakes.[4]

**Table 2.1 Annual water demand in Japan**
(billion $m^3$/annual)

| | 1975 | 1980 | 1985 | 1990 | 1995 | 2000 |
|---|---|---|---|---|---|---|
| Total water (①+②+③) | 805 | 816 | 830 | 850 | 850 | 835 |
| Urban water | 235 | 236 | 245 | 264 | 265 | 263 |
| Domestic water (Consumption/ person/day <litter> | 88 (247) | 102 (261) | 118 (287) | 135 (318) | 141 (322) | 144 (322) |
| Industrial water | 444 | 507 | 501 | 536 | 541 | 555 |
| Intake from river | 147 | 134 | 127 | 129 | 124 | 119 |
| Recycling water use (Recycling rate <%> | 297 (67.0%) | 373 (73.3%) | 374 (74.8%) | 407 (75.9%) | 417 (77.2%) | 436 (78.6%) |
| Agricultural water | 570 | 580 | 585 | 586 | 585 | 572 |

Source: Water Resources Department, Ministry of Land Infrastructure, and Development Research and Statistics Department, Ministry of Economy, Trade and Industry
1 The volume of urban water consumed are measured by water-metering penetration
The volume of agricultural water is estimated based on the volume of water intake from the river by Ministry of Agriculture, Forest and Fishery
2 Recycling rate = Recycling water use/(intake from the river + recycling water use).

[4] The Basic Environment Law enacted in November 1993 establishes two kinds of EQSs relating to water pollution: environmental water quality standards for protecting "human health", and environmental water quality standards for protecting "living environment". Each type of standard establishes certain criteria for maintaining public-water-quality.

# CHAPTER 3
# OVERVIEW OF THE GOVERNMENT'S ROLE IN WATER RESOURCES MANAGEMENT

In Japan the national government is responsible for formulating and implementing water resources policies at the national level. It formulates an overall plan of water resources development and environmental conservation. Under the framework of the national policy, local governments take charge of operation, maintenance and management of waterworks, water treatment facilities, and water utilities (see Figure 3.1).

## Organizational Structure

***The national government.*** In Japan, the national government formulates and implements comprehensive policies such as those for water resources development, the administration of waterworks, and the protection of water quality. Five related ministries (Ministry of Land, Transport and Infrastructure, Ministry of the Environment, Ministry of Health, Labor and Welfare, Ministry of Economy, Trade and Industry, Ministry of Agriculture, Forest and Fisheries) take charge of the various administrative areas, and cooperate with each other to formulate water-related policies.

The Ministry of the Environment primarily plans and formulates policies and guidelines relating to water conservation including the setting of Environmental Water Quality Standards and water pollution control measures (the *Effluent Standard settings*).

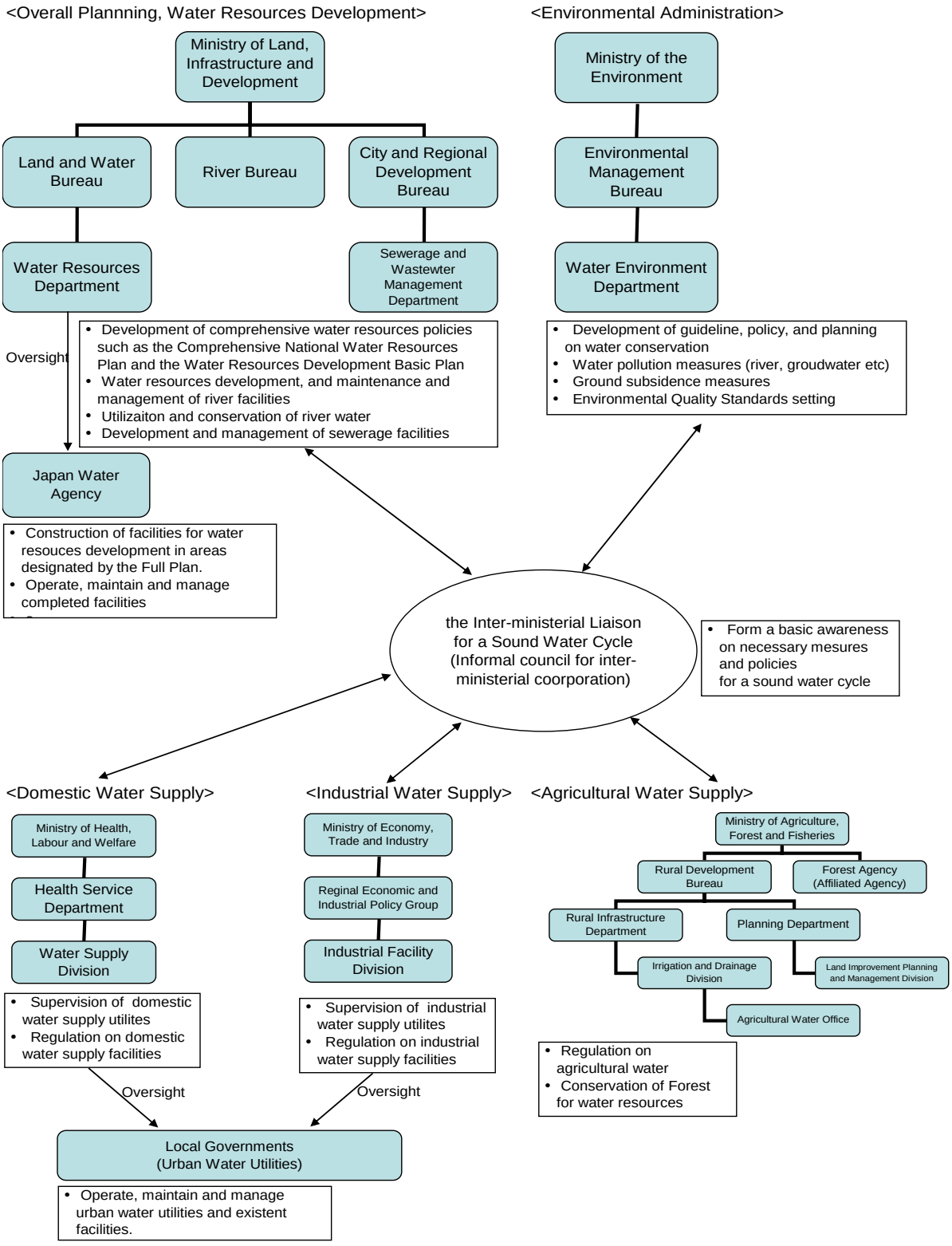
**Local governments.** In general, local governments in Japan operate, maintain and manage domestic, industrial, and sewerage water utilities and related facilities[5]. As of the end of FY2003, local governments managed 1,936 larger water utilities and 8,360 small-scaled water utilities. As a result, the proportion of the total population with access to improved water sources reached 96.9% in 2003. Local government agencies also continuously monitor public water quality and supervise private entities to ensure that wastewater effluent standards are being met.

## Overall Water Resources Planning

The national government takes charge of overall planning of both water resources development and environmental conservation. The Comprehensive National Water Resources Plan is the national basic plan for water resources development under which dams and water systems are developed. The Basic Environment Plan clarifies long-term, comprehensive environmental policies related to water quality and quantity, including water conservation.

[5] In 2001 the Water Supply Law was amended to allow urban water supply utilities to entrust a part of management of waterworks facilities such as water purification plants to a corporation including private companies. In 2003, the Law was amended to allow the ordinary local public body to entrust the administration of public facilities to corporations, including private companies.

## Figure 3.1 Japanese Government Organization



The Ministry of Land, Transport and Infrastructure prepares the *Comprehensive National Water Resources Plan* known as the *"Water Plan"*. The Water Plan is formulated and revised in accordance with the Comprehensive National Development Plan, which is stipulated in the Comprehensive National Land Development Act and approved by the Prime Minister's cabinet. The *Water Plan* is a *multi-year plan* and addresses basic medium to long-term planning issues regarding water resources development, conservation and utilization, as well as makes forecasts of long-term water demand. The Ministry of Land, Transport and Infrastructure uses the Water Plan to formulate more detailed *annual development plans* and their *related budgets*. The latest Water Plan, *Water Plan 21*, stresses the efficient utilization of existing water resources facilities rather than the development of new water resources. Given the recent tends in total water demand (essentially stable or with a slight decrease) Japan has already developed enough facilities to ensure a stable water supply.

The Cabinet, under the Basic Environment Law, approves the *Basic Environment Plan*. The December 1994 Plan set four long-term objectives: building a socioeconomic system that fosters a sound material cycle; harmonious coexistence between humans and nature; participation by all sectors of society in environmental management; and the promotion of international activities.

Uniform water quality regulations for public water and groundwater were enacted to protect human health. In order to protect the living environment, different standards were set for each type of water body including rivers, seas and coastal areas, and lakes. Currently, EQSs have been established for 26 substances relating to human health, including cadmium and total cyanide. Environmental standards were established for groundwater quality in March 1997. Additionally, 22 other substances were designated as "monitoring substances" needing further observation.

To help protect the living environment EQSs were also established for biological oxygen demand (BOD), chemical oxygen demand (COD), and dissolved oxygen (DO). Furthermore, in order to prevent eutrophication EQSs for nitrogen and phosphorus levels in lakes/reservoirs and sea/coastal areas were established.

# CHAPTER 4
# BUDGETING AND FINANCE

The national government plays a dual role in developing new water resource facilities. In addition to *planning,* the national government also *pays for* most new construction, either directly or indirectly. In most cases, over half the construction cost is directly paid for by the national government in the form of subsidies. Although remaining constructions costs should in theory be borne by local governments and beneficiaries (the water users), these groups often cannot finance the construction costs of new facilities.

In short, the national government plans new water resource development, directly subsidies up to half of the construction costs, and then provides low cost loans to local governments to allow them to "pay" for their share. As will be seen, the national government also helps subsidize user fees to reduce the "cost" of water to end users.

## The National government budget for water resources management

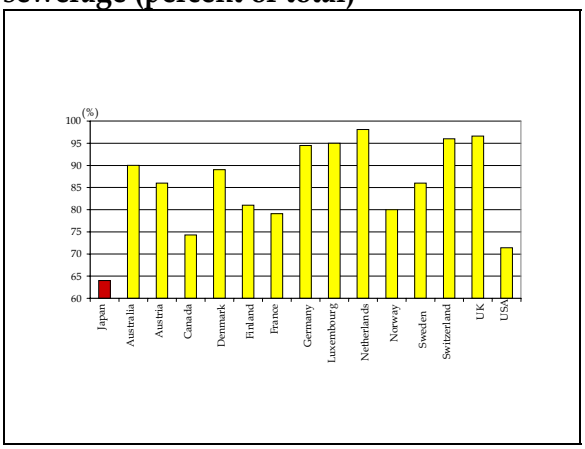
The national government spends its water budget largely for the constructions of new water resource developments and water conservation investments[6]. In FY 2005 the water-related budget (2,116,894 million yen) accounted for about a quarter of the total national budget for public works (8,325,998 million yen), which in turn was about 10% of the total national budget. The bulk of national expenditures are direct subsidies (transfers) to local governments and publicly owned water utilities for constructing new facilities. These transfers enable water utilities to maintain domestic water and sewerage water charges (user fees) at very low levels. Water users (the general public) benefit from these subsidies and can therefore afford to pay the user fees without getting into financial difficulties[7]. These transfers, therefore, are actually subsidies to water users.

The National budget is primarily used for construction of flood control facilities and sewage treatment systems. For a number of reasons (excess capacity; environmental concerns; budget concerns) the construction of new dams has been reduced, except in the case of emergency disaster prevention facilities. About 40% of the water-related budget is spent on flood control investments such as the construction of dams, waterworks, and related facilities. Around 35% of the water-related budget is spent for sewerage treatment systems. Expansion of the sewage treatment system is an important policy objective because the proportion of the population in Japan with access to sanitation in 2005 was only 66.7%, one of the lowest ratios of population with access to sewage systems among the developed countries (see Figure 4.1).

[6] The national government is allowed to bear expenses for a new construction and improvement of important civil engineering facilities related to rivers by the Local Finance Law. The River Law, Water Supply Law, Sewerage Water Law, Industrial Water Supply Business Law, and the Land Improvement Law stipulate the ratio of subsidy of the state and the local government to total projects budget individually.

[7] Water utilities set water charges to compensate operation, maintenance and management costs of their facilities; the Water Utility Laws stipulate that water utilities be managed by the Pay-As- You-Go rule.

**Figure 4.1 Population connected to sewerage (percent of total)**




Source: OECD Environmental Data Compendium 2004 (excluding Japan's data).

## Financing

Construction costs in Japan are high and revenues from water users are low. This results in the need for large subsidies for new construction, and some subsidization of on-going operation, maintenance and repair (OM&R) costs. The degree of subsidy depends on the type of water use (e.g. water supply or sewage treatment) and whether the need is for new construction or for OM&R.

Direct transfers (subsidies) from the national and local governments to public-owned water utilities pay for most of the investment expenses for newly constructed facilities such as dams, waterworks, sewerage treatment systems, and water treatment facilities. This is because water utilities cannot adequately finance construction costs from their own revenues -- basically water charges collected from water users (the beneficiaries). The budget transfers from the governments are categorized by the purpose of each transfer – flood control, sewage water treatment, domestic water supply, or agricultural water.

Local government investments and expenditures for these facilities is financed by the Fiscal Investment and Loan Program (FILP) and the issuing of municipal bonds, while national government expenditures are financed from general tax revenues and the issuing of general government bonds.
Since construction costs are so high, the local utilities cannot charge enough to recover their expenditures and they rely on the FILP to cover costs. The FILP provides loans to local utilities through the local governments. These loans are then repaid from revenues from operating facilities after completion. The lending term and repayment schedule is decided upon based on a depreciation schedule, which is usually more than 10 years.

Expenses for the operation, maintenance and management (but not construction) of existing facilities related to *flood control* and *agricultural use* are also largely financed with subsidies from the national and local governments. On the other hand, expenses for the operation, maintenance and management of existing facilities related to *sewerage treatment, domestic water supply*, and *industrial water treatment* are financed from revenues from water user charges.

**Figure 4.2 Expenses flowchart for the development of new facilities**

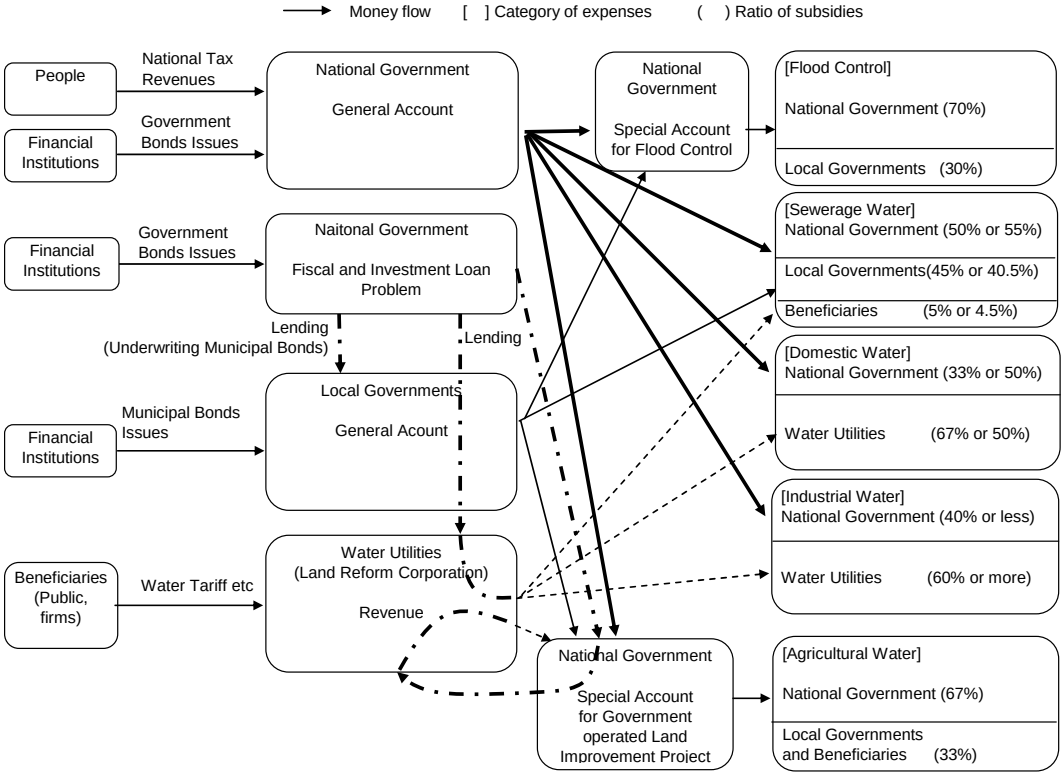
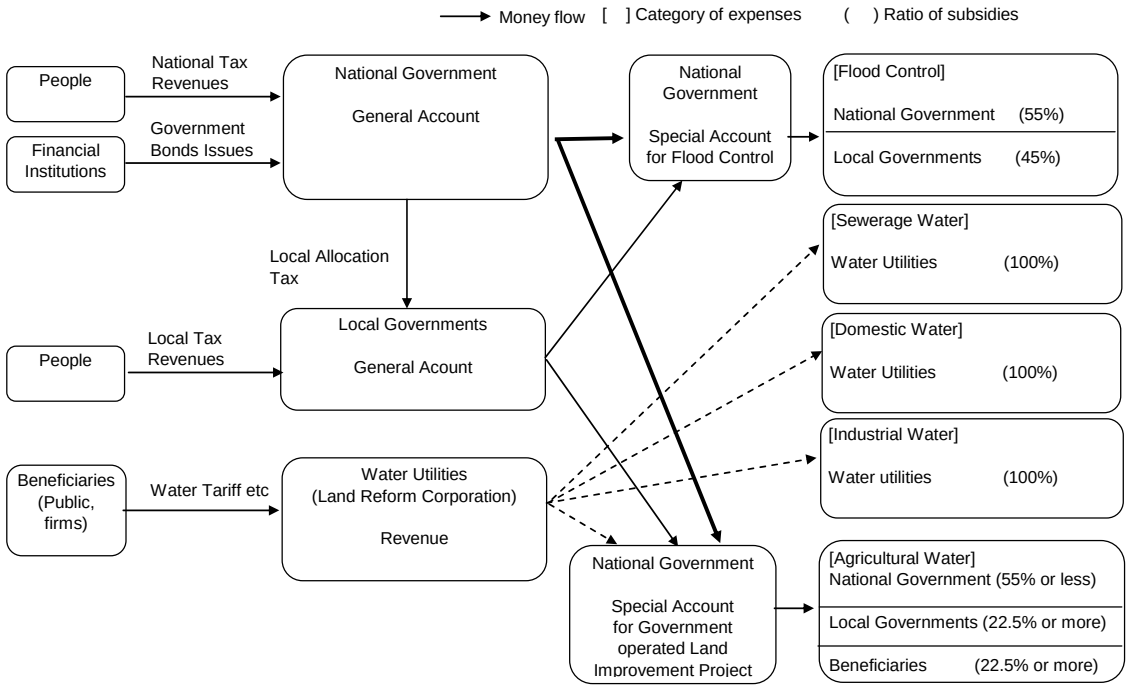



**Figure 4.3 Expenses flowchart for the operation, maintenance and management of existing facilities**



# CHAPTER 5
# THE LEGAL FRAMEWORK

The legal framework for water resources management in Japan is divided into five broad areas: (1) the overall planning of water resources development, (2) the development of water-related facilities including the basis for subsidies, (3) water rights and water trading, (4) the operation and management of water utilities including the basis for private sector participation contracts, and (5) the conservation of the water environment.

## Overall planning of water resources development

The Comprehensive National Land Development Law sets out the national plan that is the basis of the Comprehensive National Water Resources Plan (the Water Plan). Each year's budget is formulated based on the Water Plan. The Water Resources Development Basic Plan (the Full Plan) stipulated by the Water Resources Development Promotion Law is also based on the Water Plan and implemented by the Japan Water Agency (JWA) as mandated by the JWA law.

## Subsidies

The national and local governments directly finance most new construction such as dams and sewerage waterworks. Relevant laws identify each of the areas subsidized by the national government (See Chapter 6.2 for details).

## Water rights/water trading

Surface and ground water are managed differently. For *surface water users*, each public-owned water utility (for both domestic and industrial uses) and Land Improvement District (public entities for irrigation development and management) is allocated rights to river water, i.e. exclusive use of water in a certain region, according to the River Law. However, there is no comprehensive law regarding *ground water*, and users are free to withdraw ground water from wells on privately owned lands. However, the Industrial Water Law and the Law for Ground Water Use in Buildings require permits from local governments before users can withdraw/ extract ground water in areas where serious land subsidence is a concern or where ground water resources are scarce.

In general, water trading of both domestic and industrial water is prohibited by the River Law. It is only allowed inside certain Land Improvement Districts (See Chapter 6.3 for details).

## Water utilities

Water utilities are categorized by the main purpose each serves. These uses include domestic water supply, sewerage water treatment, agricultural water supply, and industrial water supply. Appropriate sectoral law regulates the operation and management of water utilities.

## Protection of water quality

The basic principles of pollution control and nature conservation are stipulated in the Basic Environment Law. More detailed guidance is given in the Water Pollution Control Law.

# CHAPTER 6
# MARKET-BASED INSTRUMENTS

As has already been mentioned, the Japanese government heavily subsidies new water resource development. The national government can adjust the ratio of subsidies for new water resources development in order to control both the development of water resources and the level of water tariffs needed to repay costs. Currently, most subsidies for new water resources development cover more than half of total construction costs. In particular, the ratio of subsidies for sewerage systems is higher than that for domestic and industrial water systems. The development of sewerage waterworks and treatment facilities is one of the highest priority areas for the Government's development of the water sector. As a result of the high level of construction (and other) subsidies (see Table 6.1), the level of water tariffs in Japan, especially that for sewerage treatment, is lower than in almost all other developed countries.

In spite of the heavy reliance on subsidies, market-based instruments are used to control both water demand and supply. In Japan, *increasing block charges and differential charges by water pipe size* are used to encourage an efficient use of domestic, sewerage and industrial water. For agricultural water, water trading between farmers is allowed within the entity called the Land Improvement District. In the case of drought, limited amounts of irrigation water can be reallocated through negotiation between member farmers to maximize agricultural production in Land Improvement Districts.

On the supply side, *private sector participation contracts* are one of the most useful methods to improve the efficiency of operation and management of water utilities. Service contracts have become very popular in many water utilities. Private Finance Initiative (PFI) methods and other "comprehensive delegation" contracts are also expected to become popular in the future. The Water Supply Law and the Local Autonomy Law have been amended to make "comprehensive delegation" contracts possible (See Annex 3 for details).

The governments also encourage water utilities to merge in order to take advantage of "economies of scale" and to help conserve water source areas to ensure environmental sustainability. For this purpose, many prefectural governments have introduced or examined the use of special purpose taxes to help maintain forest cover and prevent soil erosion. These are discussed further in section 6.5.

### Water tariffs

***Water tariff structure.*** There are various water tariff structures used in Japan, and each water utility (administered by different local public entities) has a right to decide how to set water tariffs. A typical water tariff systems is composed of two parts: a fixed charge and a variable charge. Domestic and sewerage water use is metered for single-family households and the charges are composed of fixed and increasing-block charges. Industrial water use is also metered and composed of fixed and constant volumetric charges. *Fixed charges* correspond to fixed expenses, such as capital replacement costs, not directly related to the operating level of the facility.

On the other hand, *variable charges* correspond to variable costs that vary with the operating level of the facility, such as operating and maintenance costs including personnel expenses.

**Table 6.1 Structure of water tariff in Japan**

| | Fixed charge | | | Variable Charge | | Water tariff strcuture |
|---|---|---|---|---|---|---|
| | Minimum charge | | Flat charge (per surfaced area irrigated) | Increasing block charge | Constant volumetic charge | |
| | Differenetial charge (by water pipe size) | Flat Charge | | | | |
| Domestic water | O | X | X | O | X | Two part charge (fixed + block charge) |
| Sewerage water | X | O | X | O | X | Two part charge (minimum or block charge) |
| Industrial water | O | X | X | X | O | Two part charge (fixed + volumetic charge) |
| Agricultural water | X | X | O | X | X | Flat charge |

For households, municipal users, and industry the use of *increasing block charges* and *differential charges* is an incentive-based-pricing system designed to promote efficient use of water. Households and firms have an incentive to install a smaller water supply pipe because of the differential charges based on pipe size, and they are also encouraged to use water efficiently due to increasing block charges, whereby the cost per cubic meter increases as water consumption increases.

On the other hand, agricultural water is not metered and relies on flat rate pricing. This practice encourages excessive use of water in agriculture since there is no individual "cost" to consuming more water. However, each Land Improvement District (composed of member farmers) is allocated defined water rights and they are not allowed to use more than a certain amount of water. Thus aggregate consumption is controlled. When droughts occur, however, farmers are forced to reduce their water extraction from rivers or canals. Members of Land Improvement Districts cooperate with each other to ensure efficient use of allocated water inside the districts. Moreover, they may also sell part of their water rights to urban water utilities, thereby reducing their water charges.

**Box 6.1 Water tariff structure in Tokyo**

The Bureau of Waterworks, Tokyo Metropolitan Government, operates the Tokyo water utility. Water tariffs have been set not only to cover administration costs, but also to encourage efficient water use. Both domestic and sewerage water tariffs have increasing-block charges which encourage an efficient water use. The industrial water tariff sets an upper limit to the volume of water that can be used based on the user's request. In addition, domestic and industrial water pricing systems introduce differential charges for installed water pipe sizes. Differential charges by water pipe sizes also create an incentive for the efficient use of water, because larger water pipes supply a larger volume of water per second. Remissions of water charge (a form of rebate or credit) are given to people who receive public assistance from the government.

***Water tariff level.*** In principle, water prices are set to cover operation, maintenance and management (O&M) costs of existing facilities. The water utility law stipulates that water utilities be managed on a Pay-

As- You-Go system – they must meet their on-going financial needs from the fees that they collect. This approach implies cost recovery pricing. However, since the national and local governments in fact subsidize most of the construction costs of facilities, it is not true cost recovery (See Chapter 6.2 for details).

Some sectors have substantial cost-recovery. For example, in the case of domestic water supply, typically one third to one half of capital costs and all O&M costs are financed by revenues from water charges, while two thirds or one half of capital costs are financed by subsidies. Industrial water supply also has a similar financing structure.

**Figure 6.1 Sources of financing of domestic and industrial water systems**

<table>
<tr><td colspan="2">Capital costs<br>(expenses for newly constructed facilities</td><td rowspan="2">O&M costs</td></tr>
<tr><td>Domestic water: 33% or 50%<br>Industrial water: 40%</td><td>Domestic water: 67% or 50%<br>Industrial water: 60%</td></tr>
<tr><td colspan="2">Subsidy</td><td rowspan="3">Revenue from water charges</td></tr>
<tr><td colspan="2">National Government</td></tr>
<tr><td colspan="2">Subsidies based on the law</td></tr>
</table>

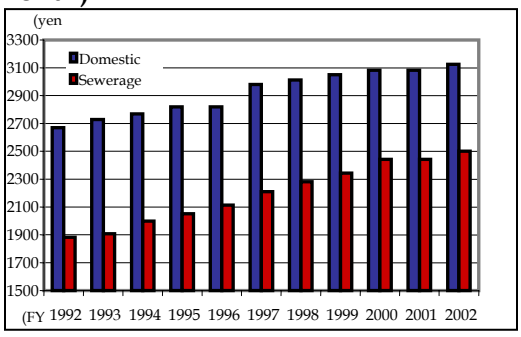
However, in the case of sewerage water treatment systems, water tariff revenues cover less than 5 % of capital costs, but do cover all of the O&M costs. The Government justifies subsidies for sanitation systems because the percentage of population with access to sanitation is one of the lowest among the developed countries. It should also be noted that very heavy subsidization of sewage-treatment systems is a common in countries around the world.

**Figure 6.2 Sources of financing resources of sewerage water systems**

<table>
<tr><td colspan="3">Capital costs<br>(expenses for newly constructed facilities</td><td>O & M costs</td></tr>
<tr><td>50%</td><td>45%</td><td>5%</td><td rowspan="4">Revenue from water charges</td></tr>
<tr><td colspan="3">Subsidy</td></tr>
<tr><td>National Government</td><td colspan="2">Local Government</td></tr>
<tr><td colspan="2">Subsidies based on the Law</td><td>Not on the law</td></tr>
<tr><td colspan="2"></td><td>40%</td><td>60%</td></tr>
</table>

Both domestic water supply and sewerage water tariffs have been gradually raised over the past ten years. However, the increase in the population covered by sanitation and clean water systems has led to expansion of systems to areas where the costs of providing services per person (or per cubic meter) have increased. This has resulted in an increase in accumulated capital investment debts, and associated operation and maintenance costs. Therefore to cover the growing O&M costs has required increasing water tariffs.

**Figure 6.3 Trend of water tariffs for an average Japanese household (using 20m³ per month)**




Source: Ministry of Land, Infrastructure and

Nevertheless, the level of sewerage water tariff for the average household in Tokyo is still much lower than in most other major world cities due to the very large subsidies to sewerage systems (see Table 6.2).

**Table 6.2 International comparisons of water tariff levels**

(Tokyo=100, as of Nov. 2001)

| | PPP Base | | Current Exchange rate base | |
|---|---|---|---|---|
| | Sewerage water | Domestic water | Sewerage water | Domestic water |
| New York | 146 | 64 | 119 | 44 |
| San Francisco | 98 | 101 | 80 | 69 |
| London | 130 | 142 | 99 | 90 |
| Paris | n.a. | 114 | n.a. | 66 |
| Frankfurt | 313 | 296 | 217 | 171 |
| Average of 5 cities | 172 | 143 | 129 | 88 |

1. Purchasing Power Parity rate (150.00 yen/US$, 23.92yen/Franc, 80.22yen/Mark, 231.12yen/Pound)
2. Exchange rate (122.31yen/US$, 16.56yen/ Franc, 55.54yen/Mark, 175.72yen/Pound).

**Subsidies for water resource development**

Subsidies are classified depending on the relevant laws, cabinet orders, and municipal bylaws. These laws and cabinet orders stipulate the ratio of subsidies to total expenses that should be paid for by the national and local governments (see Table 6.6).

There are various reasons for subsidies. For example, facilities related to flood control are thought to be a kind of public good that should be supplied by the governments. Subsidies for sewage water are justified because sewerage systems are also public goods that promote public hygiene, flood control, and water conservation. In addition, subsidies for agricultural water are needed to provide for the development of the agricultural economy and a stable supply of food in Japan. Most Japanese farms could not compete with foreign countries without these subsidies.

National and local governments bear most of the expenses for flood control and sewerage works, while they bear only a part of the expenses for domestic and industrial water supply. Operation, maintenance and management costs of existing facilities for flood control such as dams and waterworks are also borne by governments, because beneficiaries are the general public and it is hard to identify (and tax) individual beneficiaries. These subsides have been the main driving force promoting new water resources development, because most local governments can not afford to make these investments with only their own financial resources. On the other hand, the perational, maintenance and management (O & M) costs of water treatment facilities are usually borne by the users. In general, all operational costs of sewerage, domestic and industrial water utilities are borne by their users (water charges).

### Table 6.3 Price of domestic water in Tokyo

(domestic water tariff for general purpose per month after Jan, 2005 in Tokyo 23-district metropolitan area)

| water pipe size | Minimum Charge | Increasing block charge | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 1～5 $m^3$ | 6～10 $m^3$ | 11～20 $m^3$ | 21～30 $m^3$ | 31～50 $m^3$ | 51～100 $m^3$ | 101～200 $m^3$ | 201～1000 $m^3$ | 1001 $m^3$ or over |
| 13mm | 860 yen | 0 yen per $m^3$ | 22 yen per $m^3$ | 128 yen per $m^3$ | 163 yen per $m^3$ | 202 yen per $m^3$ | 213 yen per $m^3$ | 298 yen per $m^3$ | 372 yen per $m^3$ | 404 yen per $m^3$ |
| 20mm | 1,170 yen | | | | | | | | | |
| 25mm | 1,460 yen | | | | | | | | | |
| 30mm | 3,435 yen | 213 yen per $m^3$ | | | | | | 298 yen per $m^3$ | 372 yen per $m^3$ | 404 yen per $m^3$ |
| 40mm | 6,865 yen | | | | | | | | | |
| 50mm | 20,720 yen | 372 yen per $m^3$ | | | | | | | | 404 yen per $m^3$ |
| 75mm | 45,623 yen | | | | | | | | | |
| 100mm | 94,568 yen | 404 yen per $m^3$ | | | | | | | | |
| 150mm | 159,094 yen | | | | | | | | | |
| 200mm | 349,034 yen | | | | | | | | | |
| 250mm | 480,135 yen | | | | | | | | | |
| 300mm or over | 816,145 yen | | | | | | | | | |

### Table 6.4 Price of sewerage water treatment in Tokyo

(sewerage water tariff for general purpose per month after Jun, 1998 in Tokyo 23-district metropolitan area)

| | Minimum charge | Increasing block charge | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 0～8 $m^3$ | 9～20 $m^3$ | 21～30 $m^3$ | 31～50 $m^3$ | 51～100 $m^3$ | 101～200 $m^3$ | 201～500 $m^3$ | 501～1000 $m^3$ | 1001 $m^3$ or over |
| Sewerage water for general purposes | 560 yen | 110 yen per m3 | 140 yen per m3 | 170 yen per m3 | 200 yen per m3 | 230 yen per m3 | 270 yen per m3 | 310 yen per m3 | 345 yen per m3 |

### Table 6.5 Price of industrial water in Tokyo

(current industrial water tariff per month in Tokyo metropolitan area)

| water pipe size | | | 25mm | 40mm | 50mm | 75mm | 100mm | 150mm | 200mm | 250mm | 300mm | 350mm | 400mm | 450mm or over |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Minimum charge | | | 384 yen | 576 yen | 2,304 yen | 2,688 yen | 3,072 yen | 4,992 yen | 6,720 yen | 7,680 yen | 9,600 yen | 15,360 yen | 22,080 yen | 29,760 yen |
| Variable charge | Basic rate | category 1 | 29 yen per $m^3$ | | | | | | | | | | | |
| | | category 2 | 64 yen per $m^3$ | | | | | | | | | | | |
| | Excess rate | | 158 yen per $m^3$ | | | | | | | | | | | |

1 Basic rate is applied to the volume of water consumed which a water utility set each based on the request of a user.
Excess rate is a kind of penalty rate and applied if users consume excessively more than the volume set in advance.

2 Rate category1 is applied when water users switch from ground water to industrial water by disusing well and applied to half of the volume transferred.
Rate category 2 is applied to an amount of water to which category 1 is not applicable.

Source: Bureau of Waterworks, Tokyo Metropolitan Government

**Table 6.6 Subsidies as a percent of total expenses**

| Objevtive of expenses | Payer | Financing resouces | Category of expenses (Basis law for subisidies) | | | | |
|---|---|---|---|---|---|---|---|
| | | | Flood Control (River Law) | Sewerage Water (Sewerage Water Law) | Domestic Water (Water Supply Law) | Industrial Water (Industrial Water Supply Business law) | Agricultural Water (Land Improvement Law) |
| Construction of new facilities or expansion of existent facilities | National Government | Tax and Government Bond Issuance | 70% | 50% or 55% | 33% or 50% | 40% or less*1 | 67% |
| | Local Government | Municipal Bond issuance*2 | 30% | 45% or 40.5% | ---- | ---- | 33% |
| | | Fiscal Investment and Loan Program | ---- | ---- | ---- | ---- | |
| | Water Utilities (Beneficiaries) | | ---- | ---- | 67% or 50% | 60% or more | |
| | | Water Tariff Revenue | ---- | 5% or 4.5% | | | ---- |
| operation, maintenance and management cost | National Government | Tax and Government Bond Issue | 55% | ---- | ---- | ---- | 55% or less |
| | Local Government | Local Tax and Local Allocation Tax*3 | 45% | | ---- | ---- | 22.5% or more |
| | Water Utilities (Beneficiaries) | Water Tariff Revenue | ---- | 100% | 100% | 100% | 22.5% or more |

*1 No specific number is stipulated by Industrial Water Supply Business Law. The law stipulates a general basis of subisidies by the national government.The number is stipulated by the cabinet order for Japan Water Agency Law.

*2 In principle, local governments should pay out of revenues other than local bonds (or local government debts). However, they are allowed to use local bonds as financial resources for fiscal expenditures in cases where it is desirable for potential residents to share the costs for construction or other projects or where a large amount of expenditure is required immediately in a time of disaster

*3 In principle, local governments should pay out of their own financial resources from their own revenues such as local taxes. However, in fact, some local governments in rural area do not have an enough tax revenue, while local govenments in urban area such as Tokyo has excessive tax revenue. Therefore, national governments established the system for adjusting such distortion called the Local Allocaton Tax System. national governments collects and redistributes a certain portion of local tax revenue, therby securing general finances, which are available for any kind of expenditure, for local governments with limited tax revenues.

**Water trading**

In general, water trading is not allowed under the River Law. Only entities that have a clearly defined water right can withdraw water. The transfer of water rights is not allowed without a permit from the governments. Water rights for domestic and industrial use are usually allocated only to public entities owned by prefectural or city governments. In the case of an abnormal drought, the drought consultation committees, which consist of water users, local governments and the river administrator, coordinate the allocation of water and decides the degree of reductions in water abstractions according to procedures stipulated in Article 53 of the River Law [8]. However, water trading between farmers inside Land Improvement Districts is not legally restricted. In the case of drought, limited irrigation water is reallocated flexibly in order to maximize agricultural production within the Land Improvement Districts.

**Private sector participation contracts**

Private sector participation contracts are one of the most reliable methods for generating improvements in the operation and management of water utilities. Operations and management of public owned utilities tends to be inefficient because monopoly conditions (lack of competition) result in little incentive to lower operational costs [9]. Private sector participation contracts are typically categorized as one of the following systems: (1) service contracts; (2) management contracts; (3) lease contracts; (4) concessions; (5) full privatization, (6) PFI (Private Financial Initiative); and (7) private-public partnership.

[8] An abnormal drought is a defined as the most severe drought during a ten-year period.

[9] In Japan, river water rights for domestic and industrial use are allotted exclusively to public water utilities in each region. Therefore, most public water utilities function as monopolies in their service area.

***Current status of private sector participation contracts.*** The most common private sector contractual form in water utilities is the *service contract* whereby special tasks are contracted-out to private firms. According to a survey on service contracts in 2001, about 80% of water utilities use private sector service contracts for various needs such as inspection of water quality, maintenance of electrical facilities in water treatment facilities, and water metering. Private Financial Incentives (PFI ) both BTO –build, transfer, operate-- or BOO –build, own, operate, have also become possible after the PFI Promotion Law was enacted in 1999. PFI is a financing method to fund major capital investments by private funds[10]. While service contracts have become popular with many water utilities, PFI contracts and more comprehensive delegation contracts (such as management contracts and concessions contracts) have not yet become popular. Possible reasons for this include the following:

- The use of so-called "marked-up" prices, whereby tariffs are set based on expenses plus a mark-up, results in no incentive for public owned water utilities to lower their operational expenses. This procedure is outlined in the water charges guideline of the Japan Water Works Association[11].
- Most water utilities are small with high average costs, and cannot take advantage of "economies of scale". At the end of FY 2003, there were 1,936 water utilities and 8,360 small-scaled water utilities owned by local governments.

**Special purpose taxes**

In Japan, tax revenues from ordinary taxes such as income tax and corporate tax can be used for any government expense. On the contrary, revenues from special purpose taxes can only be used for specific expenses stipulated by laws or bylaws. To date various special purpose taxes have been established. For example, the special purpose taxes on gasoline and the purchase of automobiles is exclusively used for the construction and maintenance of roads. Currently, the only special purpose tax related to water resources management is the **Forest Conservation Tax.** (The Mineral Water Tax is under consideration at the local level.)

***Forest Conservation Tax.*** The Local Tax Law was amended in FY 2000 as a part of decentralization reforms and allowed local governments to establish new special purpose taxes. Based on this amendment, many local governments have introduced a special purpose tax called the Forest Conservation Tax. Revenues from the Forest Conservation Tax are used only for the conservation of forests that provide various environmental benefits such as groundwater preservation, flood control, and carbon sequestration (to yield global warming benefits). The Kouchi prefectural

[10] BTO stands for Build, Transfer, and Operate. Private Entities build a facility, transfer ownership to the public sector, but agree to operate that facility in accordance with a contract. On the other hand, BOO stands for Build, Own, and Operate. Private entities build, own and operate with an agreement to transfer the facility back to the public sector or abolish the facility as some point in the future.

[11] Japan Water Works Association is a nonprofit foundation formed by public owned water utilities. The JWWA performs various activities for the purpose of ensuring the propagation of water supplies and their sound development. There are no regulations about water pricing by water utilities. But most of water utilities set their water charges according to the guideline of the JWWA in order to secure an accountability of water pricing to their users.

government was the first local government to introduce the Forest Conservation Tax. To date, 12 other prefectural governments have decided to introduce a similar tax and several other prefectural governments are examining the idea. The average tax amount

**Table 6.7 Classification of private participation contracts**

| | Water Utility / Waterworks | | | | | | |
|---|---|---|---|---|---|---|---|
| | Ownership | Management | | | Administration | | |
| | | Overall right | Water pricing | Capital Investment | Overall responsibility | Collection of Water charge | Part of facilities |
| Service contract | Public | Public | Public | Public | Public | Public | Private |
| PFI | Public | Public | Public | Private | Public | Public | Private |
| Management contract | Public | Private | Private | Public | Private | Private | Private |
| Concession Contract | Public | Private | Private | Private | Private | Private | Private |
| Full privatization | Private | Private | Private | Private | Private | Private | Private |

is only 500 yen per household, and a set percentage of the prefectural corporate tax, resulting in an amount varying from 1000 to as much as 80,000 yen per corporation per year.

The Forest Conservation Tax is not an important source of revenues, however. Revenues from the Forest Conservation Tax usually form less than 1% of local tax revenues. These revenues are even smaller as a share of total local government income: less than 0.1% (one tenth of one percent) of all local government revenues including revenues from allocated local taxes and municipal bond issuances and transfers from the national government. In fact, the Forest Conservation Tax has usually been introduced more to make a political statement about the importance of forests than to generate significant income at the local level.

***Mineral Water Tax.*** The Yamanashi prefectural government has proposed the introduction of a *Mineral Water Tax* that is similar to the Forest Conservation Tax. The Mineral Water Tax is specifically levied on bottlers of mineral drinking water that draw ground water from the foot of Mt. Fuji in the Yamanashi prefecture. The Yamanashi prefectural government justifies the tax by stating that manufacturers gain a special marketing benefit from the good image of Mt. Fuji. The manufacturers opposed the proposal saying that the tax is against the principle of equal taxation and note that the mineral water industry uses only 2% of all ground water extracted in the region.

# CHAPTER 7
# COMMAND-AND-CONTROL MEASURES

Sometimes it is not possible to use economic instruments or market-based policies. In these cases the most effective form of management may be the use of *command and control measures*, especially to allocate water and to control pollution. In Japan, since water is considered a public good, river water rights are often allocated exclusively to public monopolistic entities. However, monopolies are often inefficient in the operation and management of facilities, and consequently private participation contracts have complemented the current water allocation systems (See Chapter 6.4 for details of public participation contracts). Command and control policies are used to help regulate wastewater effluents, especially for pollutants that are harmful to human-health. However, there are no regulations in Japan on domestic wastewater effluents.

**Water resource allocation: water rights/permits**

The River Law stipulates a formal allocation procedure for rights to river water. The law defines river water as public property, and a certain amount of river water can be withdrawn for a defined use by obtaining a "water right" through specific administrative procedures. Under the River Law, water rights for major rivers have been allocated to various uses: agricultural, domestic, industrial water supply, and hydropower generation. On the other hand, there is no comprehensive law regarding ground water use.

In general, there are no restrictions on withdrawing ground water, the ownership of which belongs to the landowner. However, ground water extraction has had a serious potential impact due to ground subsidence in urban areas such as the Tokyo and Osaka. To control this problem the Industrial Water Law and the Law for Ground Water Use in Buildings were enacted in 1956 and 1962 respectively. These laws require permits from local governments in order to withdraw ground water in certain designated areas where land subsidence is an issue or where ground water resources are scarce.

**Figure 7.1 Regulations allocating water rights (surface and ground water)**

| | Water rights | | |
|---|---|---|---|
| | **Domestic water** | **Industrial Water** | **Agricultural Water** |
| River water | River Law | | |
| Ground water | Law for Ground Water Use in Buildings | Industrial Water Law | No regulation |

**Water pollution control**

***Environmental Quality Standards.*** Under the Basic Environment Law, various Environmental Quality Standards (EQSs) for water pollutants have been specified. These standards are established to achieve two major goals: "protection of human health" and "conservation of the living environment". A single national standard was set for 26 toxic substances such as cadmium and total cyanogens. To help conserve and protect the living environment, separate EQS were set for rivers, sea and coastal areas, and lakes.

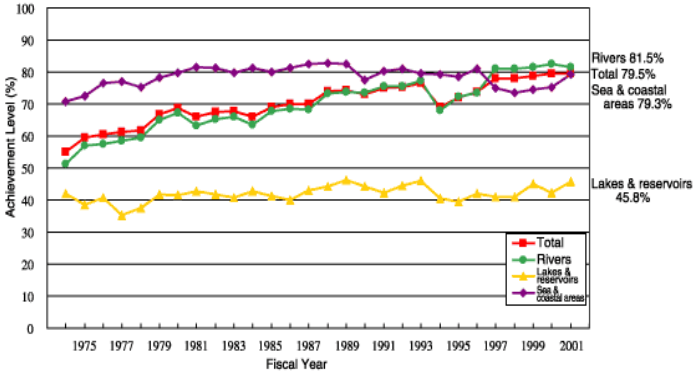
***Water quality monitoring and data disclosure.*** Under the Water Pollution Control Law, prefectural governors and the mayors of designated cities regularly monitor the water quality of public waters, and the Ministry of the Environment subsidizes the costs of this monitoring. The government promotes automated monitoring of water quality at key points in public waters. As of FY 2002, prefectural governments and designated cities had set up automated water-quality monitoring equipment stations in 125 locations and regularly published details on water quality in each location. Major waterways are also monitored. At the end of FY 2001, the Ministry of Land, Infrastructure and Transport had set up automated water-quality monitoring devices at 199 locations in 93 major waterways nationwide under the supervision of the River Management Office.

***Effluent standards and regulations for industrial water use.*** The Water Pollution Control Law sets effluent standards for factories and other entities that emit certain effluents into public waters (called "specified facilities"). The standards specify substances that could be harmful to human-health (24 substances such as cadmium and cyanide) and to the living-environment (16 items) and sets effluent limits for each. As of FY 2001, these regulations were applied to about 300,000 facilities.

The Law also requires certain factories and facilities to install specified pollution-control equipment. The governments can ask facilities to report their effluent levels and can verify with on-site inspections if necessary. If the effluents from the facility continue to violate the standards, the government can impose fines and order modifications of either the facilities or their wastewater treatment methods. Firms that emit toxins as part of their manufacturing processes must pay compensation for the harm caused to human health (no-fault liability for compensation). The Law further obliges specified facilities inside "specific designated regions" to be subject to "total pollutant load control" and regularly report to the government their pollutant discharge loads.

***Public education for efficient water use.*** Effluents from domestic activities such as cooking, laundry, and bathing are a major cause of pollution of public waters. Therefore, the Water Pollution Control Law specifies the general public's general responsibility for cooperation with government policy on water quality and water conservation. However, there are neither direct regulations nor penalties for releasing domestic effluents. The Ministry of the Environment has promoted education to enhance the public's awareness of the problem and to prompt efficient water use and voluntary reduction is domestic pollution loads.

**Figure 7.2 Environmental Quality Standards achievement trends over time (BOD/COD)**




Remarks 1. BOD used for rivers, COD used for lakes/reservoirs and sea/coastal areas
2. Achievement level (%) calculated as (no. water bodies passing/no. corresponding water bodies) x 100
Source: Ministry of the Environment, "Results of Fiscal 2001 Measurement of Water Quality in Public Waters"

As a result of all of these measures, water quality conditions have improved over time.

Levels of cadmium, cyanide, and other toxins (health-affecting substances) have been dramatically reduced. At present, there are few problems with these toxins.

However, the levels of organic contamination (substances affecting the living environment) remain high. Efforts to improve water quality in lakes, bays, inland seas, and other closed bodies of water have not been successful. Water circulation is poor in these types of closed water systems, and nitrogen, phosphorus, and other nutrients can cause rapid proliferation of algae. The progressive worsening of water quality has led to eutrophication, which causes red tides or blue tides and harms local fish populations and other aquatic life (See Figure 7.2).

# CHAPTER 8
# CONCLUDING REMARKS

In Japan, direct government subsidies have been the primary tool promoting the development of water resources. To date, Japan has developed an additional annual volume of 16.6 billion $m^3$ of water resources by constructing new dams. The national and local governments pay most of the construction costs. Currently, about 55% of total water consumption for domestic and industrial use depends on these newly developed water resources.

Water is allocated in a variety of ways. Local governments allocate river water rights for urban and industrial use to public water utilities in each region. Moreover, the Industrial Water Law and the Law for Ground Water Use in Buildings regulate ground water abstraction. These laws require permits from local governments to withdraw ground water in certain designated areas where serious land subsidence is a threat or where ground water resources are scarce.

Environmental Quality Standards, along with water quality monitoring systems and effluent regulations, have worked well to protect the overall quality of water resources. Various demand-control measures have also been implemented using both market-based instruments and regulations. For example, most public water utilities introduced incentive-based-pricing schemes such as increasing-block charges and differential user charges. As a result, water scarcity problems have decreased over time along with the gradual improvement of drinking water quality.

However, some problems remain. For example, the proportion of the population with access to sanitation is still low compared to other developed countries. Also, no regulations on domestic effluents have been introduced and levels of organic contamination affecting the living environment remain high in many/most enclosed water bodies. Another problem is the growing reliance on subsidies and associated public debt to finance water resources development. These subsidies also contribute to inefficient public investments and poor management of water utilities.

The increasing repayment burden of public debt has created calls for more efficient management of water utilities. In order to address this issue, regulations and laws have been amended to enable private entities to participate in water utilities management, but the use of Private Financial Initiatives (PFI) and comprehensive contracts are still not common. Water trading for domestic and industrial water should also be examined as another way to increase the efficiency of water use and water resource management.

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Ministry of Agriculture, Forest and Fisheries in Japan. (Agricultural Water)
http://www.maff.go.jp/nouson/nouson.htm

Ministry of Economy, Trade and Industry in Japan (Industrial Water)
http://www.meti.go.jp/

Ministry of Finance in Japan (Budget)
http://www.mof.go.jp/jouhou/syukei/syukei.htm

(Fiscal Investment and Loan Program)
http://www.mof.go.jp/jouhou/zaitou/zaitou.htm

Ministry of Health, Labor and Welfare in Japan (Domestic Water)
http://www.mhlw.go.jp/topics/bukyoku/kenkou/suido/index.html

Ministry of Land, Infrastructure and Development in Japan (Water Resources Development)
http://www.mlit.go.jp/tochimizushigen/mizsei/ (River Management)
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(Sewerage Water)
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Ministry of the Environment in Japan (Water Pollution Management)
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